Plant Biotechnology

Course Description: This course is to prepare students with interests in higher-level, science-based plant agriculture. Students enrolled in this course will study rigorous standards related to the principles of plant growth, cell structure and functions, heredity and genetics (molecular biology), plant breeding and improvement, hormones and growth regulators, chemical nature of plant life, flower structure and function, seed formation and germination, DNA and biotechnology, and emerging technologies. Students will use scientific investigation to determine a plant problem. FFA and supervised experience will be included as appropriate.

Recommended Prerequisites: Agriscience (HQ), Introduction to Agricultural Sciences or Introduction to Horticultural Sciences and Biology

Recommended Credit: 1

Recommended Grade Level: 11th or 12th

Course Codes:** A10 – **5125** or A12 - **5175**

** Use A12 Course Code number for all programs. A10 should be used for 10 month programs only.

Plant Biotechnology

Standard 1.0

Evaluate the importance of plant biotechnology in agriculture and our society.

Standard 2.0

Assess the importance of safety practices in plant biotechnology and classroom laboratory.

Standard 3.0

Conduct experiments and research in plant biotechnology.

Standard 4.0

Assess the importance of ethical issues related to plant biotechnology.

Standard 5.0

Evaluate plant genetics and heritability in relation to plant science and biotechnology.

Standard 6.0

Evaluate plant growth processes in relation to plant biotechnology.

Standard 7.0

Evaluate plant reproduction as it pertains to plant biotechnology.

Standard 8.0

Examine the process of plant tissue culture as it relates to biological engineering.

Standard 9.0

Examine the process of biological engineering as it relates to plant biotechnology.

Standard 10.0

Evaluate the impact of plant biotechnology on bioenergy.

Standard 11.0

Demonstrate premier leadership and personal growth needed for careers in plant biotechnology.

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Standard 1.0

Evaluate the importance of plant biotechnology in agriculture and our society.

Learning Expectations and Performance Indicators:

1.1 Explain terms that related to biotechnology and agriculture.
1.2 Determine why biotechnology is important to Tennessee's economy.
1.3 Distinguish the areas of science that are a part of plant biotechnology.
1.4 Identify and explain ways in which biotechnology affects our everyday lives.
1.5 Research and write a report on the career opportunities in plant biotechnology.

Standard 2.0

Assess the importance of safety practices in plant biotechnology and classroom laboratory.

Learning Expectations and Performance Indicators:

2.1 Specify and explain terms associated with laboratory and biological safety.
2.2 Discuss the meaning and importance of safety and safe work in plant biotechnology.
2.3 Identify and explain hazards in plant biotechnology.
2.4 Examine the importance in personal safety in plant biotechnology.
2.5 Use safe practices in the classroom laboratory.
2.6 Complete safety test with 100 percent accuracy.

Standard 3.0

Conduct experiments and research in plant biotechnology.

Learning Expectations and Performance Indicators:

3.1 Specify and explain terminology related to scientific investigation and experimentation in plant biotechnology.
3.2 Discuss procedures in conducting experimental research.
3.3 Explain how the research process is applied to lab and field experiments.
3.4 Assess the process of collecting data for experimentation.
3.5 Collect research data from lab or field experiments.
3.6 Evaluate the differences between findings, conclusions and recommendations.
3.7 Discuss the components and preparation of a research report.
3.8 Conduct experiments using the scientific method.

Standard 4.0

Assess the importance of ethical issues related to plant biotechnology.

Learning Expectations and Performance Indicators:

4.1 Debate ethical and practical issues surrounding biotechnology.

4.2 Assess regulatory organizations and issues concerning genetically modified organisms.

4.3 Examine ethical issues concerning the use of genetic manipulation to improve the agricultural productivity of living organisms.

4.4 Critique ethical issues arising from the use of biotechnology and genetic engineering techniques in human health care.

Standard 5.0

Evaluate plant genetics and heritability in relation to plant science and biotechnology.

Learning Expectations and Performance Indicators:

5.1 Explain terms associated with plant genetics and heritability.

5.2 Analyze the role and importance of genetics and heritability in plant biotechnology.

5.3 Illustrate and explain the importance of various plant breeding schemes.

5.4 Examine how genetic principles are used to improve agricultural production.

5.5 Identify local plants that reflect dominant and recessive traits.

5.6 Investigate how dominant and recessive genes affect plant characteristics.

5.7 Conduct research to determine how cross-pollination and selective breeding influences phenotype.

5.8 Investigate positive and negative aspects of various plant breeding schemes.

5.9 Investigate the use of asexual reproduction to have desired qualities that may not result through genetics.

Standard 6.0

Evaluate plant growth processes in relation to plant biotechnology.

Learning Expectations and Performance Indicators:

6.1 Explain the terms related to plant growth processes.

6.2 Investigate processes and requirements for plant growth.

6.3 Examine the process of nitrogen fixation.

6.4 Examine the meaning and importance of plant tropism.

6.5 Examine plant anatomy and physiology.

6.6 Examine the major physiological processes of plants and how these processes support plant growth and productivity.

6.7 Evaluate the roles of translocation, photosynthesis, respiration, and transpiration in plant productivity.

Standard 7.0

Evaluate plant reproduction as it pertains to plant biotechnology.

Learning Expectations and Performance Indicators:

7.1 Explain the terms related to plant reproduction.

7.2 Analyze the meaning and use of sexual and asexual plant reproduction.

7.3 Examine the plant parts and processes involved in sexual reproduction.

7.4 Evaluate the meaning and importance of seed viability.

Standard 8.0

Examine the process of plant tissue culture as it relates to biological engineering.

Learning Expectations and Performance Indicators:

8.1 Explain the terms related to the science of plant tissue culture.
8.2 Analyze the meaning and techniques used in tissue culture.
8.3 Assess the role of asepsis in tissue culture.
8.4 Assess the advantages and disadvantages of tissue culture.
8.5 Explain appropriate sterilization techniques used in tissue culture.
8.6 Describe the processes used in tissue culturing.
8.7 Assess appropriate care for tissue cultures to assure livability and productivity.
8.8 Determine the number of explants needed to reach a desired level.
8.9 Evaluate the types of media used for specific crops in tissue culture (or micropropagation).

Standard 9.0

Examine the process of biological engineering as it relates to plant biotechnology.

Learning Expectations and Performance Indicators:

9.1 Explain the terms related to biological engineering.
9.2 Investigate issues associated with genetic engineering.
9.3 Discuss the meaning and process of genetic engineering.
9.4 Examine the basic method of gene transfer.
9.5 Perform a gene transfer.
9.6 Evaluate gene transfer used in science applications, including the particle gun and bacterial insertion.
9.7 Identify the advantages and disadvantages of genetic engineering.

Standard 10.0

Evaluate the impact of plant biotechnology on bioenergy.

Learning Expectations and Performance Indicators:

10.1 Explain terms related to bioenergy.
10.2 Evaluate the scientific importance of bioenergy to the creation alternative fuel sources.
10.3 Discuss types of feedstock and the biotechnology used to convert biomass.
10.4 Examine the cellulosic process used in science to create bioenergy.
10.5 Analyze the advantages and disadvantages of using traditional starch-based biofuels versus using lingo-cellulosic feedstocks.
10.6 Evaluate the impact of bioenergy on Tennessee agriculture.
10.7 Examine scientific and regulatory advantages and disadvantages for bioenergy.
10.8 Evaluate the science of refining feedstock to biofuels.
10.9 Identify the available technology used in a biorefinery.

Standard 11.0

Demonstrate premier leadership and personal growth needed for careers in plant biotechnology.

Learning Expectations and Performance Indicators:

11.1 Demonstrate public speaking abilities through oral presentations and participating in career development events.

11.2 Recommend supervised agricultural experience program project that relates to plant biotechnology.

11.3 Develop public relations and citizenship skills necessary to be productive in plant biotechnology careers.

11.4 Develop work ethics and team building skills used in industry today.